Improving in Clustering based MANET using neighbor knowledge to reduce overhead

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ABSTRACT: In the dynamic network topology and mobile nature of nodes can cause challenges regarding connectivity and routing. Clustering in mobile ad-hoc networks (MANETs) is one of the effective ways to organize a network according to the network topological changes. In this paper, we propose a clustering scheme in MANET using zone-based group mobility to improve scalability and stability of overall network. A dynamic mechanism for cluster size management is taken into account to reduce network congestion and improve the performance of the MANETs in group mobility. For proper use of resources and to reduce extra energy consumption, an algorithm is also proposed to handle the isolated nodes. We evaluate scenario with different number of nodes. Simulation result shows that proposed algorithm reduces the delay and improves the network lifetime along with more robustness and reduce the power consumption.

Index Term: **Clustering, Zoned, Cluster head, neighbor knowledge, Gateway**

I INTRODUCTION:

MANET has a significant potential in multiple fields with numerous applications. It is rapidly improving and evolving for the practical implementation in several civilian and military real time scenarios. MANET has a potential to act as a backup network to facilitate users in case of failure of other networks in any disaster. The feature of data transmission at multiple hops through nodes with large coverage area makes it an ideal choice to be used in natural disaster and emergency situations. Furthermore, MANETs consists of mobile nodes capable of creating a network topology with dynamic environment. These mobile nodes can move freely without any use of centralized infrastructure [1].

Data transmission between mobile nodes is achieved by using routing protocols and performance of any network depends upon it [2]. Clustering is one of the types of routing and an effective way to transfer data between nodes in a network. It can improve the overall scalability of the network and provide stability by using hierarchical network environment. In clustering based MANETs, entire network is divided into small groups named as a clusters [3]. A cluster consists of cluster member nodes, gateway nodes and cluster head (CH) shown in fig 1. A cluster design mechanism mainly consists of two stages, i.e. cluster formation stage and cluster management stage. The initial cluster formation of these schemes, a mobile node can decide to become a Cluster head only after it exchanges some specific information with its neighbors and assures that it holds some specific attribute in its neighborhood. A cluster head normally serves as a local coordinator for its cluster, performing intra-cluster transmission arrangement, data forwarding,

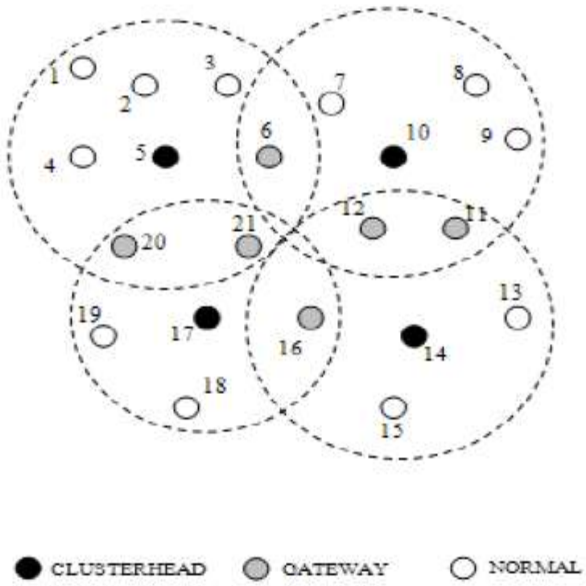

Fig 1

and so on. A cluster gateway is a non-cluster head node with inter-cluster links, so it can access neighboring clusters and forward information between clusters. A cluster member is usually called an ordinary node, which is a non-cluster head node without any inter-cluster links.

II RELATED WORK

Many studies have been conducted to increase the performance of the routing protocol. Kun-Won et al.[4] suggested a new and secure routing protocol for sensor networks that combines the traditional routing protocols with security routing protocols through encryption and decryption methods in the design process. The results of this study suggest that the new protocol is more effective and it is recommended over previous routing protocols than previous routing protocols. Rezaee et al. [5] established a new cluster-based routing protocol for use in the ad-hoc network. It depends on the cluster formation to increase the packet delivery ratio (PDR) and to minimize end-to end delay. The cluster head (CH) can be modified if the original node is damaged in the suggested method. The new node is used to send data, thus minimizing the probability of error.

Jason et al. [6] proposed a new cluster routing protocol (CBRP) for a mobile ad-hoc network. It applies a specific algorithm to select the gateway node and limits this selection according to the weight and energy of the nodes. The simulation results of this study indicate that node selection significantly reduces energy consumption and improves the quality of the routing protocols. Rashed et al. [7] presented a new two-layer hierarchical routing protocol that is the modified form of the low energy adaptive clustering hierarchy (LEACH) protocol. The main concept behind this design is the use of the number of CHs and the number of sensors to aggregate the cluster information obtained from the receiving node. The simulation results of this study show that the new routing protocol consumes reduced amounts of energy and limits the time delay in data transfer.

Pandi et al. [8] proposed a new cluster ad-hoc routing protocol that depends on multiple sources and multicast features to enhance the performance of the proposed protocol. The original weighted cluster algorithm was simply modified for this purpose. The simulation results suggest that the new routing protocol generates a high PDR; however, the maximum number of the normalized control overhead is excessive. Dongfeng et al. [9] designed an efficient cluster based routing protocol for sensor networks. The main principle behind this approach is reflected in CH selection; each node can elect itself as a CH. The simulation results confirm that this new routing protocol is better than the LEACH and CROSS routing protocols in terms of energy consumption and end to-end delay.

Sara [10] proposed a zone base protocol using neighbor coverage base probability rebroadcast (NCPR). The simulation result shows that if increase in number of node will increase the execution time and delay. This paper proposed a improvement in packet deliver ratio as increase in node and decrease in delay.

III CLUSTER SELECTION

The process of dividing the network into interconnected substructures is called clustering and the interconnected substructures are called clusters. The cluster head (CH) of each cluster act as a coordinator within the substructure. Each CH acts as a temporary base station within its zone or cluster. It also communicates with other CHs [5]. The Cluster based routing provides an answer to address nodes heterogeneity, and to limit the amount of routing information that propagates inside the network. The grouping of network nodes into a number of overlapping clusters is the main idea behind clustering.

Environment size is divided into 600 × 600 , there are four separation of zone. The node in black color is a cluster head. Node with black color red hexagon is a gateway which use to give a route when node are in different zone.

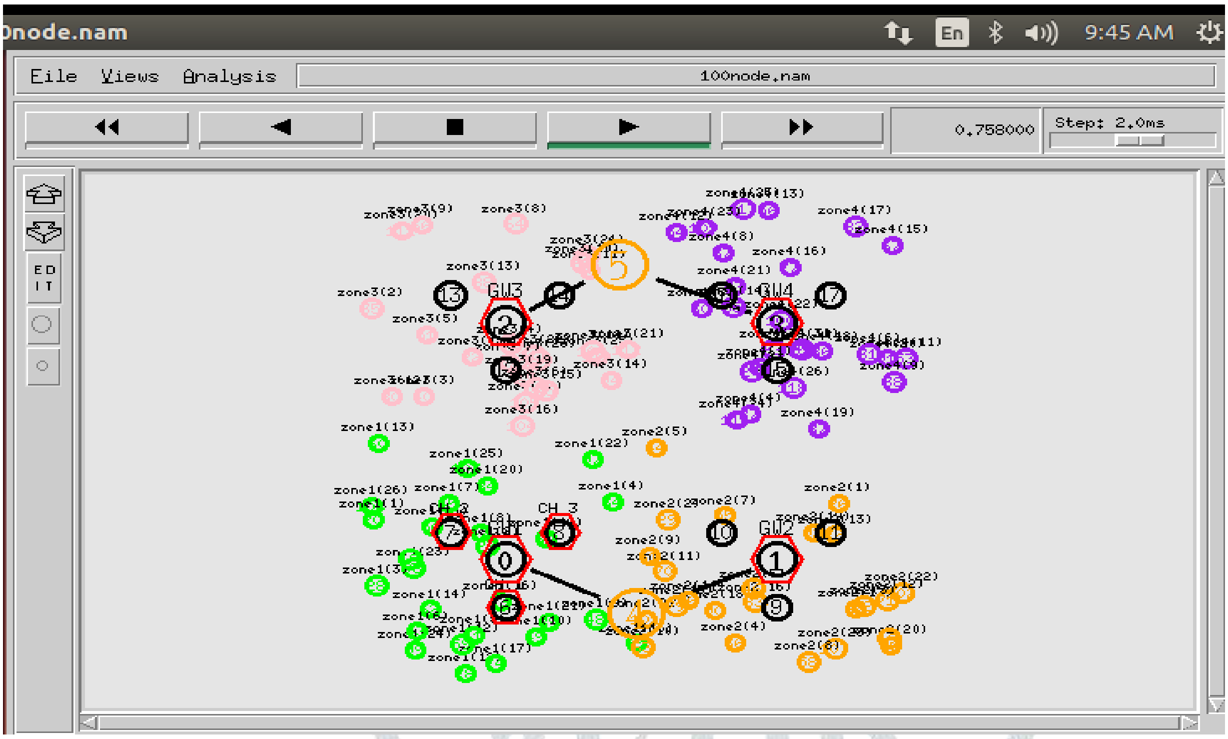

Figure :2

For Zone 1/ Cluster 1
The node which are in the range of x and y are less than 300 and more than 0 will come under Zone 1 or cluster 1. From the above figure 2 the node which are in green color are belong to Zone 1 or cluster 1.
If 300> x > 0 and 300> y > 0

For Zone 2/ Cluster 2
The node which are in the range of x more than 300 and less than 600, for a y in the range of more than 0 and less than 300 will come under Zone 2/cluster 2. From the figure 2 the node in orange color are belong to zone 2/ cluster 2.
300<x<600 and 300> y > 0

For Zone 3/ Cluster 3
The node which are in the range of y more than 300 and less than 600, for a x in the range of more than 0 and less than 300 will come under Zone 3/cluster 3. From the figure 2 the node in pink color are belong to zone 3/ cluster 3.
300<y<600 and 300> x > 0

For Zone 4/ Cluster 4
The node which are in the range of x more than 300 and less than 600, for a y in the range of more than 300 and less than 600 will come under Zone 4/cluster 4. From the figure 2 the node in purple color are belong to zone 4/ cluster 4.
300<x<600 and 300<y<600

III EXPERIMENTAL EVALUATION AND RESULTS ANALYSIS

The Cluster Based Routing Protocol with neighbor knowledge have been tested through several experiments using NS-2 simulation to compare between different number of node. NS-2 is a component based and discrete event network simulator, and it is the most common in computer networks.

Simulation parameter

Simulation parameters	**Value**
Routing protocol Type	AODV NCPR
Number of node	100 to 500
Simulation Area	600 X 600
Traffic pattern	CBR
Packet size	200
MAC type	802.11

Radio Propagation Model	Two-ray ground
Transmission range in cluster head	100m
Simulator	NS2

Table 1

a. Average delay

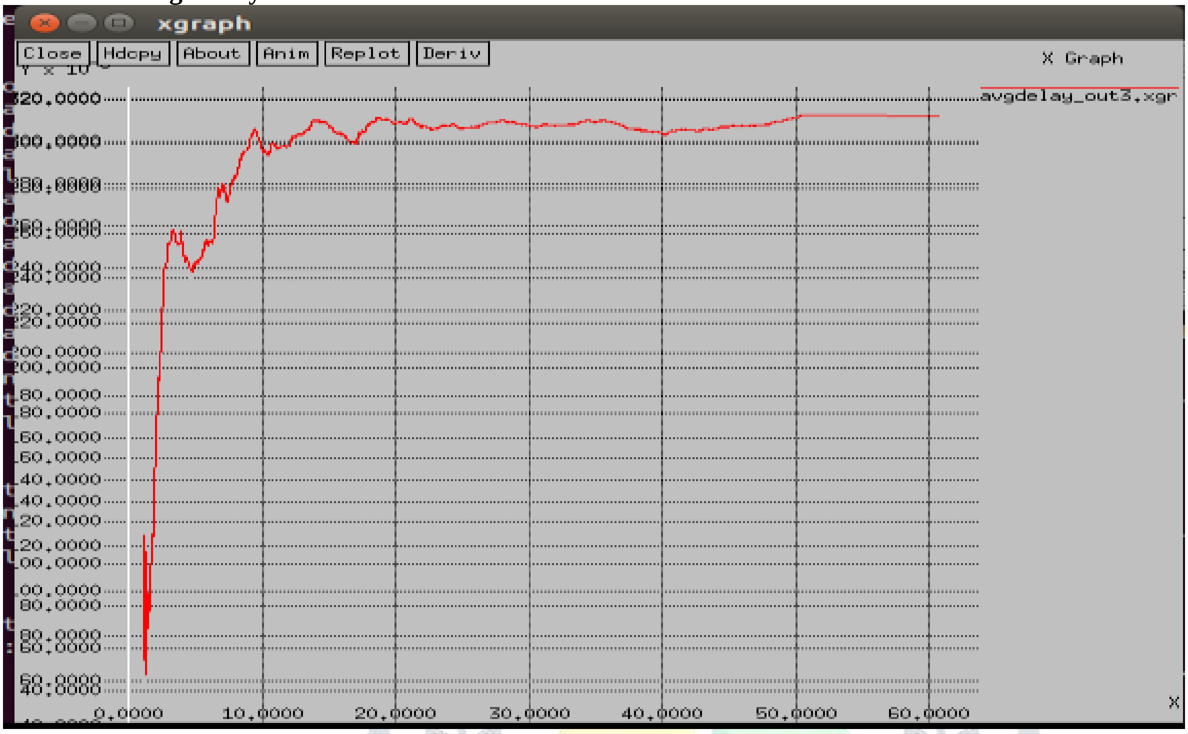

Fig 3

Fig 3 shows the average delay with number of nodes is 100. Average end to end delay in previous system retransmission rate is more as there was more transmission of RREQ packet.

b. Packet deliver ratio

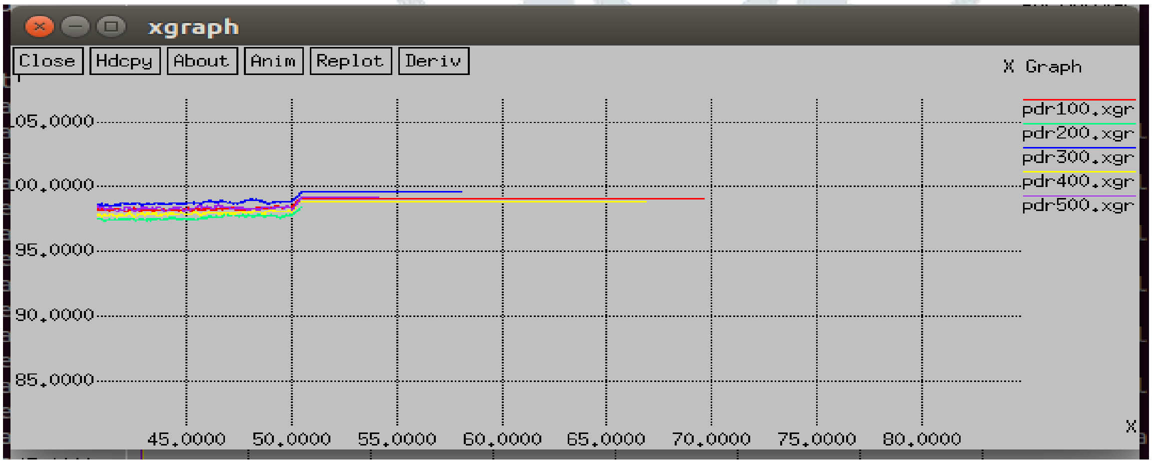

Figure 4

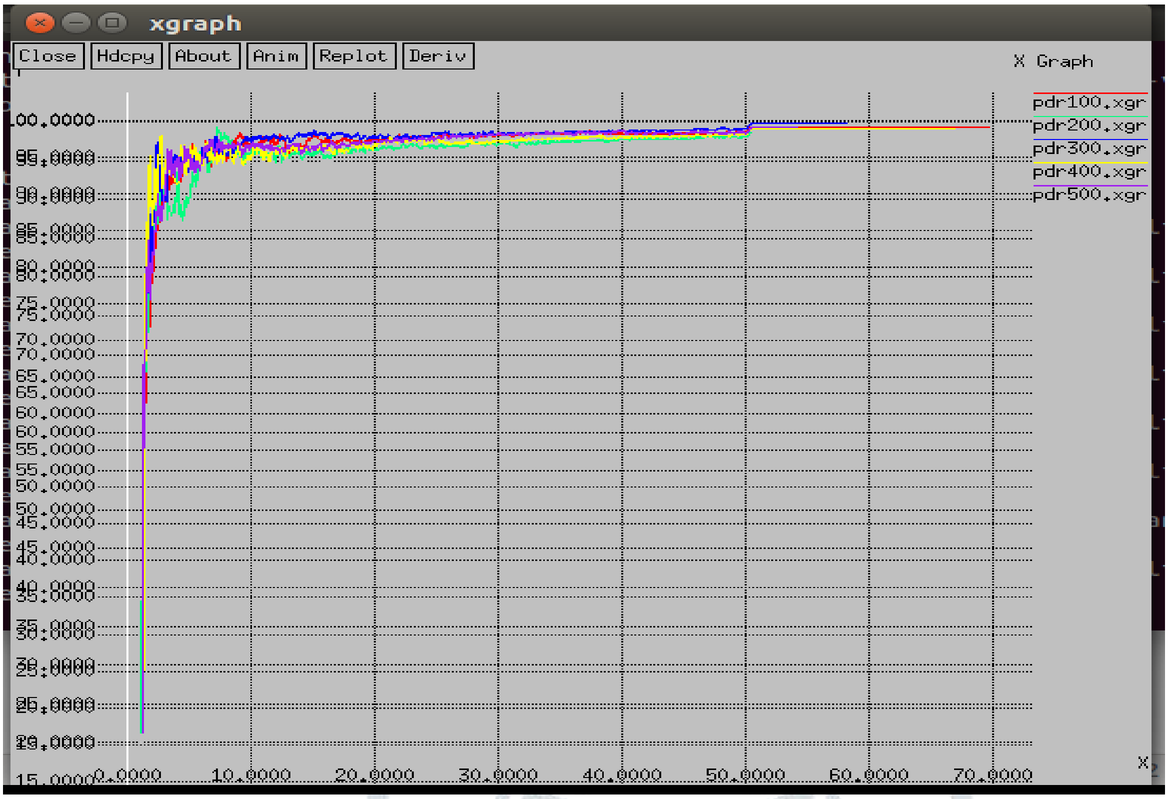

Figure 5

Fig. 4 and 5 shows the packet delivery ratio with increasing network density. The NCPR with cluster protocol can increase the packet delivery ratio because it significantly reduces the number of collisions, so that it reduces the number of packet drops caused by collisions. When network is dense, the NCPR protocol increases the packet delivery ratio.

c. Average delay with different number of nodes

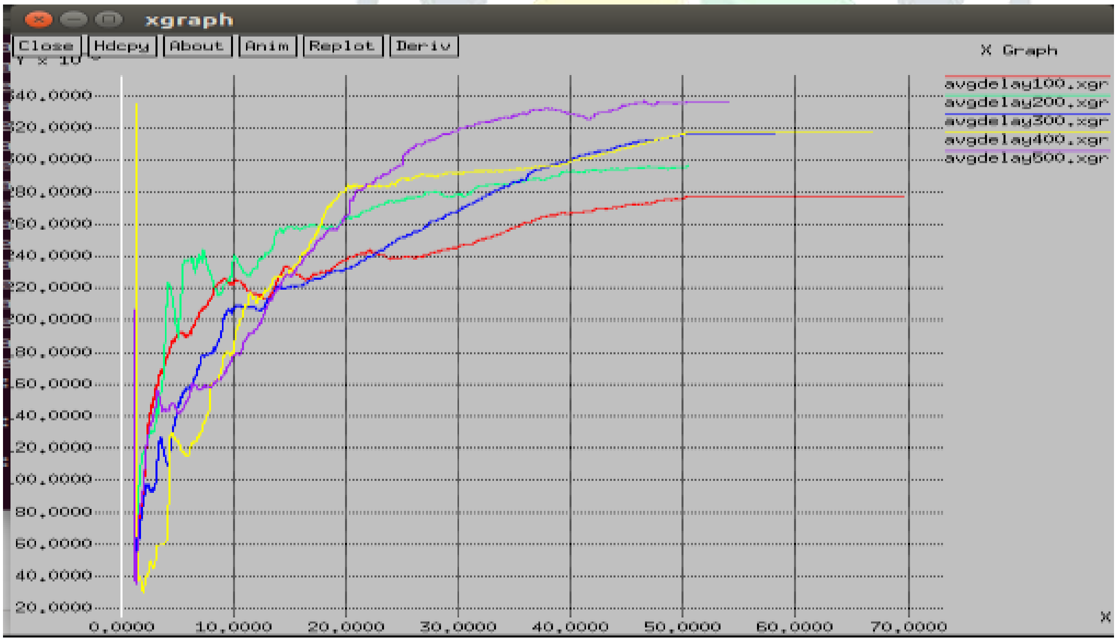

Figure 6

Fig 6 shows the behavior of normalized routing overhead with increasing number of nodes. On an average the overhead is reduced when compared with NCPR. Figure shows the normalized routing overhead with varying network density. NCPR with cluster protocol reduces the routing overhead which occurs during the route discovery process it also reduces the number of RREQ packets. As a result, there is a significant decrease in routing overhead. With 300 nodes delay is less as compare with dense network.

IV CONCLUSION

Reducing routing overhead is very challenging task in MANET. In MANETs, when network's size exceeds a certain threshold decreases the performance, resulting in many routing algorithms performing only when network's size is small. To overcome reduce routing overhead and increase in End-to-End delay it is mandatory to make network organized and manageable. The scheme is used for integrated routing and message delivery in clustered networks. The proposed clustering architecture was evaluated using experiments. The proposed technique shows that the algorithm builds stable clusters with low communication overhead due to its localized, distributed and reactive nature. Which will not only reduce the routing overhead, it will also decrease End-to-End delay and increase Packet Delivery ratio with improving efficiency. It also increases execution time in dense network.

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